pose very well. Mr. Ward's advice, however, will not encumber the most precise disposition. The writer must confess that he has about the same feeling in regard to this whole subject as he has expressed in the matter of microscopes. An herbarium, like a microscope, should not be an end, but simply a means to an end, and when it ceases to be that, it becomes a mere toy, like a collection of postage stamps or crockery. It is to be feared that the craze for collecting has infected too many of our botanists whose whole enjoyment of their plants is the miser's enjoyment of his gold. All the collecting that is being done in this country should yield us richer returns of information. Every herbarium, however small, should be a perennial fountain and not a stagnant pool. Mr. Ward enforces well the real object of an herbarium, but that part of his advice will be less heeded than the mechanrical part.

The Leaves of Aquatic Plants.—The leaves of aquatic plants may be divided into 3 classes; aerial, floating and immersed. The first class has stomata on both sides of the leaf; the second, on the upper side only; and the last class has none at all. In the first two, the air can be taken through the stomata directly into the leaf; in the last class, the necessary gases not existing as a body (of air) in the water, there is no use for stomata, which would take up water as well as air. So we have breathing holes in the leaves disconnected from direct contact with water and into which carbon dioxide is absorbed for the use of the plant (BOT. GAZ., Vol. VI. No. 8). These are the well-known intercellular spaces. So we see that it is a natural division.

To the first class belong the leaves of the subaquatic or marsh plants, which root in the water and send their branches into the air, as in *Nasturtium officinale*.

To the next belong the leaves of *Nymphæaceæ*, *Limnanthemum*, *Orontium* and *Marsilea*, raised by petioles to the water surface, also those of *Schollera* and *Callitrichaceæ* (aquatic forms) raised by stems to the same level. The peduncles of some water flowers are also elongated to get to the air.

To the last class belong some *Isoetes*, *Potamogetons*, *Vallisneria*, *Ranunculus divaricatus*, and most *Utricularieæ*.

Some plants combine the second and last classes, having both floating and immersed leaves (some species of *Potamogeton*).

Some, the first and last classes, have both aerial and immersed leaves, as *Nasturtium lacustre* and *Myriophyllum*.

A few plants having stomata (first class), beginning their existence in the water, emerge as the latter dries up.

Plants of the second class, disconnected from the land and often very small, are sometimes matted to keep the stomata-bearing surface upward. This is effected in *Azolla* by its branching habit, in

Wolffia and *Lemna* by the coherence for a time of the proliferous parent to its offspring. The yielding to currents of water is a matter of indifference, unless it be to carry the plant into new food regions, which is certainly not well accomplished in some ponds. The disconnection with the soil keeps the stomata above water in the ever changing level of ponds. This is a matter of prime importance to leaves of the second class. A root that would bind our *Wolffia* to the soil would take many times the material of the plant itself. The same thing is effected in others of this class by long petioles and stems which being pliable allow the leaves to float on the water, for if attached stiffly to the stem the running stream would tilt the leaf towards its downward course, and by being longer than absolutely necessary, it allows the leaf to surmount the rise of a stream as well as to follow it in its fall. The same remarks apply to the pliability of stems which having immersed leaves must still effect the elevation of their supplementary floating (*Potamogeton*) or aerial (*Nasturtium lacustre*) leaves, which would otherwise not perform their functions. Floating leaves are generally entire and simple in form to aid their floating; this is supplemented in *Nymphæa regia* by the raised border of the leaf.

Immersed leaves are long and linear (*Potamogeton*, *Vallisneria*) or divided into coarse or capillary segments. These leaves must remain in the water, since out of it they cannot live and also have no stomata to breathe with. So we find arrangements to keep them in the water as long as there is any; the leaves are flaccid or the stem may be weak, and so they rise and fall with the height of the water (some immersed *Potamogetons* and *Vallisneria*.) The two cases are often correlated in capillary leaves, *Utricularia* and *Ranunculus aquatilis*, var. *trichophyllus*), while in other specimens these leaves may be stiff, depending on the flexible stem entirely (*Nasturtium lacustre* and *Ranunculus aquatilis*, var. *stagnatilis*). Since these plants breathe in the water and the amount of surface exposed is an item for them, we find capillary division abounding among immersed leaves. But while aerial leaves have strong fibers to spread out the leaf to the best possible advantage this is effected in water plants by large air holes in the leaf; this may explain their flaccidness also.

Plants having stomata supplemented by large air tubes may lead a double existence, living first in water, and later on the dried-up bottoms of pond or stream as in *Isoetes* and perhaps *Vallisneria septangulare*, *Elatine*, &c. Is not this principle of the uses of leaves a more complete key to these facts than that of changing currents?

(See in this connection "Designs of some leaf-forms" in the March No. of the *Torrey Bulletin*.)—AUG. F. FOERSTE, *Dayton, O.*

Recently Introduced Plants in and about Rockford, Ill.—The rapidity with which our thriving western cities run through